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ABSTRACT

The objectives of this module include students being able to: measure using the metric system, determine ratios of different types, and analyze a problem using ratios. Some of the worksheets require the development of ratios from physical activity; others require the development and analysis of ratics using parts of the student's own body. Teaching suggestions are included. (MK)

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ENVIRONMENTAL MODULE FOR USE IN A MATHEMATICS LABORATORY SETTING

People Patterns - RATIO

by

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SE 030 309

People Patterns - RATIO

This module may be used in several ways.

1. It may be used to supplement existing materials.
2. It may be used as a unit, with all students working together as a large group.
3. It may be used in small groups, with each group reporting the results.
4. The activities may be used as eyeopeners for other units.

Materials

Contained in this module:

1. Student Worksheets #1 to 11

Teacher must provide:

1. Baseball (or softball)
2. Several cardboard boxes (or wastebaskets)
3. String
4. Meter stick
5. Bathroom scales

Optional (teacher provides)

1. Measuring tape (metric)
2. Typewriter

OBJECTIVES

.Given a problem, students will be able to measure objects and people with metric system.

.Given measurements, students will be able to determine ratios of different types.

.Given ratios, students will be able to analyze a problem using the ratios.

OVERVIEW

The module has activities grouped together in the following ways:

In Student Worksheets #1 to 3, students develop ratios from some physical activity.

In Student Worksheets #4 to 11, students develop and analyze ratios using parts of their body.

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OUTLINE

I. Student Worksheets #1, 2, and 3

A. Materials provided:

1. Student Worksheets #1, 2, and 3

B. Materials needed:

1. Ball
2. Cardboard boxes (several) or waste-baskets
3. Waste paper

C. Work to be completed by students:

1. Student Worksheets #1, 2, and 3
2. Students might share data and come up with relevant uses of ratios in data assessment.

D. Teaching suggestions:

1. You could break the students into groups on Student Worksheets #1 and 2 and use these activities as a game, keeping team ratios.
2. You may want to compare the ratios of these activities with any other ratios or comparisons we use in everyday living.

II. Student Worksheets #4 to 11

A. Materials provided:

1. Student Worksheets #4 to 11

B. Materials needed:

1. String
2. Meter sticks
3. Bathroom scales
4. Metric measuring tape (optional)

C. Work to be completed by students:

1. Student Worksheets #4 to 11
2. Students might compare results and come up with common terms for their ratios.

D. Teaching suggestions:

1. You may want to group the students with similar interests in these activities.
2. You may wish to take the results and compare them with People Patterns - STATISTICS.
3. You may want to use these activities to develop interest in other units.
4. You may want to use the following resources for continuing instruction on Student Worksheet #11:

a) Movie: "Donald in Mathmagic Land"
b) Mathematical Puzzles and Diversions. Martin Gardner, Simon and Schuster, 1961.
c) The Golden Section and Related Cariosa. Garth E. Ruinon, Scott Foresman, 1972.

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Heave Ho

You will need a softball for this experiment. Go out to a baseball field, football field, or an open area. Each person throws the ball as far as they can. Measure each throw and find the mean (average) throw of each person.

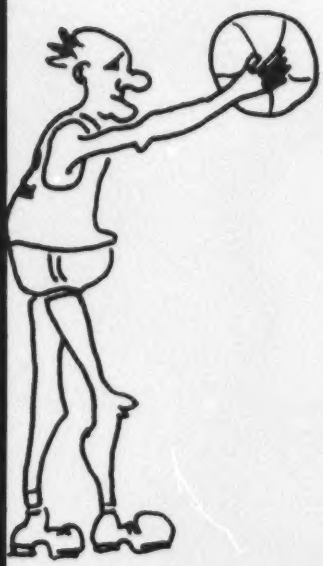
Weigh each person and find the ratio of throwing distance to weight.

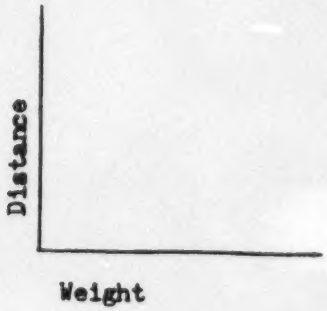
$$\frac{\text{Throwing distance}}{\text{Weight}}$$

What does this ratio tell us?

Is it constant or does it change radically for each person?

Can you graph these results?





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Baak-It

You will need several boxes (or wastebaskets) and some scrap paper. Set the boxes on the floor and mark off a point 20 feet from the boxes. Each person takes five paper wads and attempts to throw them into the baskets or boxes. Keep track of the times thrown and the number of shots that go in.

Find the ratio of "hits" to total shots. This ratio is similar to the batting average in baseball, which is a ratio of hits to times at bat. You may want to post the results and rank according to the ratios (largest to smallest).

You might wait a week and try this experiment again, to see if the ratios noticeably change.

Does the size of the box make a difference?

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Needs

People are all sizes and shapes and generally appearances are different. They also think differently. Are the needs of people different?

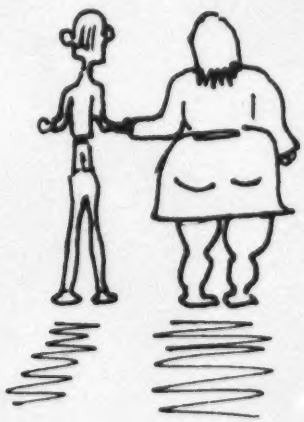
Find out how many of last year's graduates in your school have gone to college. Can you put this into a ratio?

$$\frac{\text{college-bound}}{\text{total graduates}}$$

List the courses your school offers and determine which ones are "college prep" (those courses geared for college-bound people). Can you find the ratio of courses that are college-bound to all courses?

$$\frac{\text{college-bound}}{\text{total courses}}$$

What decision might you make about your students' needs from these statistics?



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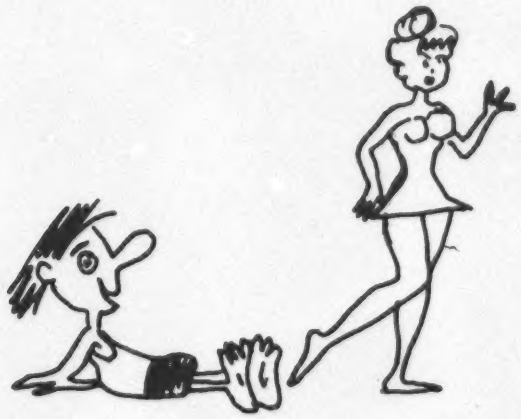
36-24-36 (91.4-61-91.4)

We get a mental picture of a woman when we see or hear the vital statistics 36-24-36 (91.4-61-91.4). With men, we don't have that type of statistic available to get a good mental picture. We get the statistic that he's 180 cm. tall, or he's 70 kg.-- yet, this doesn't give us an accurate picture.

Could we develop a male set of statistics to correspond to the female 91.4-61-91.4? What measurements would you use? Chest, neck, biceps, forceps, head, waist, hips, thigh, height, weight, or maybe a ratio of some of these would work.

Develop a uniform set of statistics for men and use it with the male members of your class. Compare your system with other students' systems.



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Up in Arms

Using a sample of people, find the length of their arms from the elbow to the wrist. Find the ratio of this length to their height.

Is this ratio the same for all people? Does the ratio change from boys to girls? with different-aged people?

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Flex It

Take a piece of string (about 50 cm. long), and measure the size (circumference) of your bicep (upper arm muscle) extended. Measure the length of string or a meter stick to find out how many centimeters the circumference is. Next measure the same bicep flexed. Divide the extended size into the flexed size. This gives you a ratio of extended to flexed. For example, my extended bicep is 27.5 cm. - flexed it is 32 cm. This ratio is:

$$\frac{\text{flexed - extended}}{\text{extended}} = \frac{32 \text{ cm.} - 27.5 \text{ cm.}}{27.5 \text{ cm.}} = \frac{4.5 \text{ cm.}}{27.5 \text{ cm.}} \quad \text{or} \quad 27.5 \overline{)\,4.50}\,.16$$

or a 16% increase.

Does the size of the person affect this ratio?

Does the sex of the individual affect this ratio?

You may want to try the ratio of waist size to height, or the ratio of chest (normal) to chest (expanded).

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Touch 'n Go

Take a sample from your typing class listing people's names and their average typing speed in words-per-minute. Measure the length of all four fingers on each hand. Take the ratio of average finger length to the words-per-minute. Compare each student's ratio.

Does this ratio remain fairly constant?

What does this ratio tell us?

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Stand up straight, with your arms reaching out to the side as far as possible. (You now look like the letter T.) Have someone measure the distance from the fingertip of your left hand to the fingertip of your right hand. (We call this your reach.) Next, measure your height. The ratio of reach to height $\frac{\text{reach}}{\text{height}}$ on many people is one.

What deduction might you make about a person with a $\frac{\text{reach}}{\text{height}}$ ratio greater than one?

What deduction might you make about a person with a $\frac{\text{reach}}{\text{height}}$ ratio less than one?

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Measure the length of your hand span (the distance from your thumb to your little finger). Next, measure the distance around your wrist.

The ratio of $\frac{\text{hand span}}{\text{wrist}}$ on many people is one. What ratio of $\frac{\text{hand span}}{\text{wrist}}$ do you have?

Next, measure the distance around your neck. Find the ratio of your $\frac{\text{neck}}{\text{wrist}}$. Many people have a $\frac{\text{neck}}{\text{wrist}}$ ratio of two.

Measure your waist. Find the ratio of your $\frac{\text{waist}}{\text{neck}}$. Many people have a $\frac{\text{waist}}{\text{neck}}$ ratio of two.

Can you find any other ratios of people's measurements that remain fairly constant?

Try $\frac{\text{wrist to elbow}}{\text{foot length}}$. What ratio do most people in your class get?

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Measure the length from your wrist to your elbow. Find how long your foot is. What is your $\frac{\text{wrist to elbow}}{\text{foot length}}$ ratio? Many people have a $\frac{\text{wrist to elbow}}{\text{foot length}}$ ratio of one.

Measure the length from the top of your shoulder to your wrist. Next, measure the distance around your head. What is your $\frac{\text{shoulder to wrist}}{\text{head}}$ ratio? Again, many people have a $\frac{\text{shoulder to wrist}}{\text{head}}$ ratio of one.

Can you find any other different measurements from your body where the ratio is one? What are these?

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Golden Girl

Pick any two integers (they may or may not be the same). Start an additive series, using your two numbers as the first two numbers in the series. (An additive series is formed by adding two succeeding numbers together to get the next number in the series.) As an example, I will pick 1 and 1. My series will begin with 1,1,2,3,5,8,13,21,34,55,...., where each term is the sum of the preceding two terms; i.e., 2 + 1 = 3.

Find the ratio of any two consecutive terms from your series; for example, $\frac{55}{34}$. Find at least five of the ratios of consecutive terms (don't use the first three terms). As you find more of these ratios, the value of the ratios will approach 1.618. A ratio that approaches the value of 1.618 is called the golden ratio. This ratio has served as the ratio for many artists and architects. If the ratio of the sides of a rectangle has a value of 1.618, we call this rectangle a golden rectangle. Golden rectangles were the basic design of the Parthanon in ancient Greece.

People, also, have an approximation of the golden ratio. Measure the distance from your navel to the floor. Next, measure your height. The $\frac{\text{height}}{\text{navel}}$ ratio on many people has an approximate value of 1.618, or the value of the golden ratio. An interesting fact about the value of the golden ratio, 1.618, is that its inverse, $\frac{1}{1.618}$ turns out to be .618.

Find the average $\frac{\text{height}}{\text{navel}}$ ratio from your class. How close is the class average to the value of the golden ratio?

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